CHAPTER 21

LEAD

2101 Applicability

a. The provisions of this chapter apply to industrial and construction work and supplement references 21-1 and 21-2.

(1) Construction work covered by reference 21-2, includes any repair or renovation activities or other activities that disturb in place lead-containing materials (LCM) (e.g., steel structure renovation and repair), but does not include routine cleaning and repainting (e.g., minor surface preparation and repainting of rental apartments between tenants or at scheduled intervals) where there is insignificant damage, wear or corrosion of existing lead-containing paint, coatings or substrates.

(2) Employees performing maintenance activities not associated with construction work are covered by the general industry standard for lead, reference 21-1. Maintenance activities covered by the general industry standard are those which involve making or keeping a structure, fixture, or foundation in proper condition in a routine, scheduled or anticipated fashion.

2102. Discussion

a. The goal of this chapter is to prevent lead intoxication and related injuries during the use, handling, removal and melting of materials containing lead at Navy activities.

b. Lead, as used in this chapter, means metallic lead, all inorganic lead compounds and organic lead soaps. All other organic lead compounds are excluded. Lead's abundance, low melting point, high molecular weight, high density and malleability make it a useful structural material. When added to resins, grease, or rubber, lead compounds act as antioxidants. Common uses for lead and lead compounds include:

(1) Ballast

(2) Radiation shielding

(3) Paint filler and hardener

(4) Rubber antioxidant

(5) An acoustical insulation component

(6) Solder for electrical components and pipe joints

(7) High voltage cable shielding

(8) Small arms ammunition

(9) Batteries

(10) Roof flashing

(11) Weights

While not an absolute indicator, red, forest green, chrome yellow, "school bus yellow", and "Occupational Safety and Health (OSH) yellow" paints typically contain lead components, such as lead oxides and lead chromate. Lead is also found in polyurethane and water base paints.

c. Significant lead exposures can occur during:

(1) Lead and babbitt melting and casting

(2) Ballast handling

(3) Spraying, sanding, grinding, burning, welding and abrasive blasting of lead containing materials and paint

(4) Soldering with torches

(5) High voltage cable repair

(6) Abrasive blasting with smelting slag

(7) Lead-acid battery reclaiming

(8) Machining lead

(9) Handling of contaminated personnel clothing, etc.

(10)Bullet trap clean-out/general cleaning at firing ranges.

d. Lead has long been a recognized health hazard. Lead can damage the nervous system, kidneys and reproductive systems. Chronic lead exposure can initially damage the blood forming organs. Higher levels can result in reproductive dysfunction in both men and women, and it can cause peripheral nerve and central nervous system changes. Lead inhibits heme synthesis and at high levels leads to anemia. Lead can pass through the placenta and lead levels in the mother's blood are comparable to concentrations of lead in the umbilical cord at birth. The fetus and newborn may be at least as susceptible to neurological damage as young children.

e. In recognition of the serious health hazards associated with, and the numerous sources of, potential lead exposure, the Navy has established strict controls to limit both occupational and environmental exposures. Navy activities shall apply standards and controls discussed in this chapter to all personnel ashore. Reference 21-3 discusses the lead control program for forces afloat. Work which falls under the OSHA construction standards, i.e., construction, demolition, renovation, or repair of structures, follow the requirements in reference 21-2.

2103. <u>Permissible Exposure Limit (PEL) and Action Level Triggering Requirements</u>

a. <u>PEL</u>. The PEL for an 8-hour time-weighted average (TWA) exposure to airborne lead is 50 micrograms per cubic meter ($\mu g/m^3$) of air. For employee exposure of more than 8 hours in a work day, the PEL shall be determined by the following formula.

$$PEL(\frac{mg}{m^3}) = \frac{400}{No.\ Hours\ Worked\ Per\ Day}$$

Activities shall implement engineering and administrative controls to the extent feasible to reduce the exposure to below the PEL when an employee's exposure exceeds the PEL for more than 30 days per year. Wherever the engineering and work practice controls that activities institute are not sufficient to reduce employee exposure to or below the permissible exposure limit, the employer shall nonetheless use engineering controls to reduce exposure to the lowest feasible level and shall supplement them by use of respiratory protection. Where an employee is exposed to lead above the PEL for 30 days or less per year, activities shall use engineering controls to reduce exposures at least to 200 $\mu g/m^3$. Thereafter, use any combination of engineering, work practice, and respiratory protection controls to reduce employee exposure to or below 50 $\mu g/m^3$.

b. <u>Action Level (AL)</u>. The AL for an 8-hour TWA exposure to airborne lead is 30 $\mu g/m^3$ (without regard to respirator use). Exposure to airborne lead at or above the AL, for more than 30 days per year, shall

trigger biological monitoring and medical surveillance.

2104. Control of Lead in the Workplace Environment

Chapter 5 discusses the basic principles for controlling hazards in the occupational environment including substitution with less hazardous materials, engineering controls (closed systems, thermostats), administrative controls (job rotation, work time limits), and use of personal protective equipment (PPE), in that order.

a. General Workplace Control Practices.

(1) The Navy shall not use paints containing more than 0.06% lead by dry weight unless the cognizant headquarters command specifically approves higher lead content paint.

(2) Before proceeding with work involving paint, the activity must determine if the paint contains sufficient lead to warrant applying lead controls for the work to be performed. This may be accomplished via testing of the paint using a valid laboratory method, or through established and accurate records which provide the needed information (e.g., paint application records coupled with lead content data from material safety data sheets, product labels, prior testing results, or other valid documentation). The cognizant OSH Professional or Industrial Hygienist shall determine the lead monitoring and controls required for the work. This determination shall be based on the lead content of the involved paints, the work methods to be employed, and observation, calculations, or previous measurements relevant to the employee exposure potential of the work in question.

(3) When feasible, activities shall minimize the heating of lead and leaded materials through the use of thermostatically controlled heating or the removal of lead containing surface coatings or contaminants prior to heating.

(4) Activities shall establish procedures to maintain work surfaces as free of lead dust as is practical and shall clean up lead dust with high efficiency particulate air (HEPA) filtered vacuum cleaners. They may only use wet sweeping and brushing when vacuuming or other equally effective methods have been tried and found to be ineffective or infeasible. Activities shall not use compressed air to clean work surfaces or work floors.

(5) Activities that have lead containing waste, scrap, debris, containers, equipment, and clothing consigned for disposal shall collect it, seal it in impermeable containers, and label waste per paragraph 2105.

(6) To minimize exposure potential, activities shall isolate hot work on lead and abrasive lead removal operations to the extent feasible, from other operations.

b. Ventilation. Local exhaust ventilation is frequently required to ensure that atmospheric levels of lead particulate do not exceed the PEL. The list below contains general requirements for the design and use of ventilation to reduce exposures. The cognizant industrial hygienist shall provide specific guidance for each lead operation.

(1) The cognizant industrial hygienist shall provide recommendations regarding specific equipment design parameters and system servicing procedures for each operation.

(2) Activities shall design, construct and maintain local exhaust ventilation and dust collection systems per references 21-4 through 21-7.

(3) Activities shall test ventilation systems used to control lead exposures or emissions using qualified engineering or industrial hygiene personnel at least every 3 months and within 5 days of any production, process, or control change which may result in a change in employee exposure. Where devices such as manometers, pitot tubes, etc. are installed to continuously monitor the effectiveness of ventilation systems, activities shall instruct employees who use the system on the meaning and importance of the measurements and to immediately contact their OSH office if the measuring devices indicate a malfunction. Where such devices are in place, industrial hygiene or engineering personnel only need to inspect the ventilation systems annually.

(4) Activities using ventilation systems to control occupational exposures or emissions shall not directly exhaust into any work space or to the atmosphere. They shall not recirculate air from operations generating lead. The activity environmental manager shall approve the air pollution control system after consulting with the cognizant air pollution regulatory agency.

(5) The industrial hygienist shall review the ventilation design for ease of maintenance and accessibility, as well as design errors, and shall pay special attention to hoods, duct work, clean out hatches, exhaust fans and air pollution control devices. Activities shall install the exhaust fan, after the air pollution control system, in a protected and restricted room or shed. If a HEPA filter is required and the filter and prefilter housing is located outdoors, they shall use a bag-in, bag-out style access housing.

c. <u>Personal Protective Clothing and Related Control Facilities.</u>

(1) Personnel engaged in operations where the concentration of airborne lead particulates is likely to exceed the PEL or where the possibility of skin or eye irritation exists, shall remove clothing worn to and from work and wear the protective clothing provided by the Navy. Employees shall use waterproof clothing when handling wet lead. Protective clothing includes:

(a) Full body, one-piece coveralls shall be used.

(b) Personnel shall use durable gloves and head covering. Hoods shall extend beyond the collar of the coverall, completely protecting the neck area.

(c) Activities shall provide slip-resistant shoe covers or lightweight rubber boots and may also use disposable shoe covers.

(d) Activities shall provide face shields, vented goggles, or other appropriate protective equipment for use whenever the possibility of eye hazard exists.

NOTES:

The proper use of protective clothing requires that employees close all openings and that garments fit snugly about the neck, wrists and ankles. Accordingly, employees shall tape the wrist and ankle junctions, as well as the collar opening on coveralls as necessary, to prevent contamination of skin and underclothing without restricting physical movement.

(2) Activities shall provide clean protective clothing at least weekly. Clean protective clothing shall be provided daily when the 8-hour TWA airborne concentration exceeds 200 $\mu g/m^3$.

(3) Activities shall provide change rooms as close as practical to the lead work area(s) for employees who work where the airborne lead exposure is above the PEL (without regard to the use of respirators). They shall maintain change rooms under positive pressure with respect to adjacent lead work areas. They shall post protective clothing removal procedures in the change room and include vacuuming of clothing (before removal and while still wearing a respirator, if one was required for the task) using a HEPA filter vacuum. Removal of lead particles from clothing by blowing or shaking is prohibited.

(4) Employees exposed to airborne lead concentrations above the PEL (without regard to respirator use) shall shower at the end of the work shift. Activities shall locate shower facilities between the clean and dirty change rooms for employees to shower at the end of their work shift. Change rooms shall have two separate clothing lockers for each employee to prevent contamination of street clothes and to ensure that employees do not leave wearing any clothing or equipment worn during their work shift. Supervisors shall ensure that employees shower at the end of their work shift.

(5) Employees shall not take lead-contaminated clothing home to be laundered. Activities shall launder lead-contaminated clothing in a manner to prevent release of lead dust in excess of the AL. Contracts governing laundering of lead-contaminated clothing shall specifically require that contractors comply with the precautions specified in reference 21-1.

(6) Activities shall transport lead contaminated clothing in sealed containers to which are affixed the standard "caution label" (see paragraph 2104e). Activities shall notify persons who clean or launder protective clothing or equipment in writing of the potentially harmful effects of exposure to lead.

d. Respiratory Protection

(1) Limits of Respirator Usage

(a) Activities shall use engineering control measures per paragraph 2104 and shall not achieve compliance with PELs solely by the use of respirators except under the following conditions:

1. During the time period necessary to implement engineering control measures

2. In work situations in which the control methods prescribed are not technically feasible or are not sufficient to reduce the airborne concentration of lead particulates below the PEL

3. During emergencies.

(b) Where respirators are required to control exposure to lead, activities shall select respirators per appendix 21-A, and comply with the respirator program per chapter 15 of this manual and reference 21-8.

(c) Activities shall supply a powered air purifying respirator with a HEPA filter in lieu of a half or full face piece respirator, if the employee chooses to use this respirator and it provides adequate protection.

(d) Activities shall provide a respirator to employees who work with lead, upon request, and shall enter the

employee into the respiratory protection program.

e. Warning Signs and Caution Labels

(1) Activities shall provide and display warning signs at each location where airborne lead concentrations may exceed the PEL. Activities shall conspicuously post signs so personnel may read them and take necessary precautions before entering the area. They shall clean and illuminate signs required by this paragraph as necessary so that the legend is readily visible. Signs, in compliance with reference 21-1, may contain a listing of required protective equipment and shall state, as a minimum, the following:

WARNING

LEAD WORK AREA

POISON

NO SMOKING, EATING OR DRINKING

(2) Activities shall affix caution labels to containers of contaminated clothing, equipment, raw materials, waste, debris, or other products containing lead if, in any foreseeable way, these products could produce levels of airborne lead which might constitute a threat to health. These caution labels shall state:

CAUTION

CLOTHING CONTAMINATED WITH

LEAD

DO NOT REMOVE DUST BY

BLOWING OR SHAKING

DISPOSE OF LEAD-CONTAMINATED

WASH WATER IN ACCORDANCE

WITH APPLICABLE LOCAL, STATE

OR FEDERAL REGULATIONS

f. Lunch Rooms and Personal Hygiene

(1) Activities shall provide lunchroom facilities for employees who work in areas where their airborne lead exposure is above the PEL (without regard to the use of respirators).

(2) When activities locate lunch facilities adjacent to the lead work area, such facilities shall have a positive pressure, filtered air supply and be readily accessible to employees.

(3) Employees shall remove protective clothing and equipment before entering lunchroom facilities.

(4) Activities shall prohibit eating, drinking, chewing or the use of tobacco products, the application of makeup and storage of food and tobacco products in lead work areas.

(5) Lead workers shall wash their hands and face prior to eating, drinking, using tobacco products or applying cosmetics.

2105. Environmental Protection and Waste Disposal Procedures

a. Navy activities must take care to ensure that measures taken to meet local and national environmental standards are compatible with the requirements of this chapter.

b. Activities shall require, prior to disposing of hazardous lead waste, bagging in heavy duty plastic bags or other impermeable containers and labeling with caution labels described in paragraph 2104e(2). Personnel shall label lead waste containers such as bags, trash cans, dumpsters, etc., "LEAD WASTE ONLY" and exercise care to prevent bags and other containers from rupturing when being moved to a dumpster or other suitable

vehicle for transport to a hazardous waste disposal site.

c. Activities shall dispose of lead containing materials per applicable Federal, State and local environmental requirements. The cognizant environmental manager shall determine environmental requirements relating to lead emissions/disposal.

d. Technical assistance for air pollution control is available upon request from the Naval Facilities Engineering Command (COMNAVFACENGCOM) Engineering Field Divisions (EFDs).

2106. Training

All Navy personnel who work in areas where the potential exists for lead exposure at or above the action level, or for whom the possibility of skin or eye irritation exists shall receive initial training prior to or at time of assignment and at least annually thereafter. The training, per reference 21-1, shall include, as a minimum, the following:

a. The specific nature of the operations during which exposure is possible

b. The purpose, proper selection, fit testing, use, and limitations of respirators

c. The adverse health effects of lead with particular attention to the reproductive effects upon both males and females

d. The purpose and description of the medical surveillance program, including the use of chelating agents and medical removal protection benefits

e. The engineering controls and work practices to be applied and used in the employee's job, including PPE and personal hygiene measures

f. The contents of the command's compliance plan.

NOTE:

All employees in a workplace in which there is a potential for exposure to airborne lead at any level shall be informed of the contents of appendices A and B of reference 21-1, and to any related documents, all of which are available at no charge from the Department of Labor (DOL). In addition, employees shall receive, upon request, any other handout type materials in use or related to the training program.

2107. Industrial Hygiene Surveillance

Exposure Monitoring Plan. For any lead operation with the potential to cause employee exposure at or above the action level (without regard to the use of respiratory protection), activities shall conduct initial and periodic industrial hygiene evaluation and exposure monitoring (under the guidance of the cognizant industrial hygienist) per reference 21-1 and chapter 8 of this manual.

2108. Employee Notification

Within 5 working days after the receipt of monitoring results, the command shall notify each employee in writing of his/her exposure monitoring results. Whenever the results indicate that the employee was exposed above the PEL, without regard to respirator use, the written statement shall include that fact and a description of the corrective action(s) taken to reduce the individual's exposure.

2109. Medical Surveillance Program

a. General. This program consists of three basic elements:

(1) Preplacement medical evaluation

(2) Semi-annual blood lead monitoring

(3) Follow-up medical evaluations based on the results of blood lead analysis and physician opinion.

Activities shall include personnel in this program when industrial hygiene surveillance indicates that they perform work or are likely to be in the vicinity of an operation which generates airborne lead concentrations at or above the AL for more than 30 days per year. Examinations may include special purpose histories and physical examinations, and laboratory tests designed to detect early signs of lead overabsorption. Refer also to reference 21-9 for medical protocols and guidance. Activities shall base inclusion into this program on airborne concentration measurements without regard to respirator use and, therefore, inclusion does not indicate that an individual is overexposed to lead.

b. Program Elements

(1) Preplacement Evaluation. All Navy personnel shall receive a preplacement evaluation as described in reference 21-9 prior to assignment to a position involving potential exposures to lead that equal or exceed the AL.

(2) Blood Lead Levels and Frequency of Monitoring. Navy activities shall make blood lead analysis and Zinc Protoporphyrin (ZPP) available every 6 months for all personnel who are or may be exposed to lead above the AL for more than 30 days per year. Supporting medical facilities shall perform analysis every 2 months when the blood lead level exceeds 30 μg/100g of whole blood.

(3) Follow-up Medical Surveillance

(a) Individual Reassignment/ Medical Removal. An employee shall be reassigned to non-lead work:

1. If an employee's blood lead concentration equals or exceeds 60 μg/100g

2. If the average of his/her last three blood lead measurements equals or exceeds 50 μg/100g; however, Individuals need not be removed if their last blood test indicates a blood lead level at or below 40 μg/100 g.

3. Or, if the employee has signs or symptoms of lead toxicity.

For additional guidance concerning removal procedures, return to former job status, and removal protection requirements, refer to reference 21-1. Activities shall also reassign pregnant women exposed to lead at or above 50 $\mu g/m^3$ or with a blood lead level of 30 μg/100g blood to a job without lead exposure, with medical removal benefits.

(b) Follow-up Blood Lead Monitoring. Activities shall perform follow-up lead monitoring within 2 weeks of the receipt of an initial or routine monitoring result with a blood lead concentration at or above 30 μg/100g of whole blood, and periodically thereafter according to the following criteria.

1. During medical removal (to non-lead work activity), activities shall monitor the employee's blood lead

concentration monthly until the employee's last two consecutive test results are at or below 40 μg/100g, at which time the employee may be returned to his/her regular work activity.

2. When an employee's blood lead concentration is between 30 and 40 μg/100g, the activity shall monitor it every 2 months until the last two consecutive blood lead test results are less than 30 μg/100g.

(c) Follow-up Evaluations

1. Medical Follow-up. Activities shall conduct a medical evaluation identical to the preplacement evaluation, with the exception of chest x-rays, annually for each person found to have a blood lead concentration at or above 30 μg/100g at any time during the prior year.

2. Reassignment Termination of Employment Follow-up. Activities shall conduct a medical evaluation identical to the preplacement evaluation just prior to the reassignment or termination of an employee from a job requiring medical surveillance.

3. Physicians Written Opinion. Reference 21-1 requires a written opinion and reference 21-9 provides a sample written opinion.

4. Industrial Hygiene Follow-up Investigation. The cognizant industrial hygienist shall be notified of, and perform an investigation to determine the cause of, each blood lead concentration at or above 30 μg/100g which has been verified by follow-up blood lead monitoring.

(d) Other Appropriate Medical Evaluations. The cognizant medical activity shall perform a medical examination, including those elements of the preplacement examination, which the physician deems necessary:

1. As soon as possible after notification by an employee that he/she has developed signs or symptoms commonly associated with lead intoxication.

2. As soon as possible after notification that the employee desires medical advice concerning the effects of current or past lead exposure on the ability to procreate a healthy child.

3. As soon as possible after being informed that the employee demonstrates difficulty breathing during a respirator fit test or during respirator use.

4. As medically appropriate for personnel who have been removed from exposure to lead due to risk of sustaining material impairment to health, or otherwise limited pending a final medical evaluation.

c. Administrative Procedures

(1) Employee Notification. An activity shall notify the employee of the following, in writing, within 5 working days after receipt of results, when his/her blood lead level is at or above 30 μg/100g whole blood:

(a) His/her blood lead concentration level, as reported

(b) That the regulations require temporary medical removal with Medical Remove Protection benefits when, and if, the employee's blood lead level exceeds the current numerical criterion for medical removal under reference 21-1.

(2) Employee Counseling. The physician shall counsel personnel regarding any abnormalities detected during any screening test. The physician shall make

an entry into the employee's medical record which describes the counseling given. The employee shall countersign this entry.

d. Medical Records

(1) Each employee record shall include the following identifying information:

(a) Name

(b) Social security number

(c) Date of birth

(d) Dates of examinations

(e) Job titles, job codes, and/ or primary and secondary Navy Enlisted Classification Code (NEC).

(2) All records of examinations, possible lead-related conditions, related laboratory results, and all forms and correspondence related to the employee's medical history shall become a permanent part of the health record. The cognizant activity shall retain such records for the period of employment plus 20 years, or 40 years, whichever is longer.

(3) Medical facilities shall enter the judgment of the occupational health physician concerning the adequacy of the diagnostic information to support the impression of lead-related disease in the medical record. Lacking definitive information, the evaluating physician must exercise his/her best medical judgment on each individual case.

(4) Activities shall make available copies of any examinations, laboratory results, or special studies in an employee's health record or compensation folder to a physician of the employee's choice after execution of a proper release of information form.

(5) Should the Navy select the initial physician, the employee may designate a second physician to review any findings and conduct independent examinations and tests as may be deemed necessary. The Navy shall provide to the initial and consulting (second) physician the following:

(a) Copy of reference 21-1 and this chapter

(b) Description of employee's duties

(c) Employee's exposure level

(d) Description of PPE

(e) Blood lead determinations

(f) All prior written medical opinions.

(6) The cognizant medical activity shall maintain these medical records.

(7) Each individual currently or previously employed by Department of the Navy (DON) or any other person he/she may designate shall have access to the records, as paragraph 2109d(2) defines, within 15 days of the request.

2110. Work Performed by Private Contractors

a. Use references 21-10 and 21-11 to design lead contract specifications in Navy facilities.

b. Contract administrators shall insure that each contract, for work performed by an independent contractor in the United States or overseas which may involve the release of lead dust, shall incorporate the appropriate references and clauses to ensure that:

(1). The contractor is aware of the potential hazard to his/her employees and Navy personnel.

(2). The contractor complies with references 21-1, 21-2, 21-3, and 21-12 to protect his/her employees, as well as Navy personnel.

(3). The contractor shall control lead dust outside of the work boundary to less than 30 $\mu g/m^3$ at all times, and shall perform sufficient monitoring to confirm that this level of control is maintained. In addition, the controlled work area(s) shall meet this criteria prior to release for unrestricted access. Contractors shall provide copies of their monitoring results to the cognizant industrial hygienist.

2111. Responsibilities

a. The Chief, Bureau of Medicine and Surgery (BUMED) shall:

(1) Centrally manage the Lead Medical Surveillance Program ashore and afloat.

(2) Provide professional industrial hygiene technical support and training assistance to commands for the purpose of evaluating the potential for lead exposure.

b. Commanders of Echelon 2 and other headquarters commands shall:

(1) Provide advice and technical assistance to define appropriate engineering and work practice controls, and to identify acceptable lead free substitute materials.

(2) Ensure program support by budgeting the resources required to meet the regulatory standards for the control of lead as prescribed by this chapter.

(3) Determine the applicability of reference 21-2 to any operations within their respective claimancies and provide policy and guidance to affected commands and activities. This will require procedures to ensure pre-placement medical screening and training are provided to workers based on occupational "task based triggers" specified in reference 21-2.

c. COMNAVFACENGCOM shall:

(1) Provide advice and technical assistance concerning lead paint in Navy buildings, particularly housing, child care facilities and hospitals.

(2) Ensure that contracting officers and representatives receive the appropriate level of training to adequately plan, design, oversee and review lead construction work.

d. Commanding Officers of shore activities shall:

(1) Apply control measures and monitoring procedures prescribed in this chapter to processes using lead or lead containing materials.

(2) Budget resources in order to meet these lead control requirements.

Chapter 21

References

21-1. Title 29 Code of Federal Regulations (CFR) 1910.1025, Lead (as amended) (NOTAL)

21-2. Title 29 CFR 1926.62, Lead in Construction (NOTAL)

21-3. OPNAVINST 5100.19C of 14 Jan 94, Navy Occupational Safety and Health Program Manual for Forces Afloat (NOTAL)

21-4. Title 29 CFR 1910.94, Ventilation (NOTAL)

21-5. American Conference of Governmental Industrial Hygienists Pub. No. 2092, Industrial Ventilation: A manual of Recommended Practice, 23rd Edition (NOTAL)

21-6. American National Standards Institute Z9.2 of 29 March 1979, Fundamentals Governing the Design and Operation of Local Exhaust Systems (NOTAL)

21-7. MIL-HDBK-1003/17C of 29 Feb 96, Industrial Ventilation Systems (NOTAL)

21-8. NEHC Technical Manual, Industrial Hygiene Field Operations Manual, latest revision

21-9. NEHC Technical Manual, Medical Surveillance Procedures Manual and Medical Matrix, latest revision

21-10. NFGS 13282, Removal and Disposal of Material Containing Lead (NOTAL)

21-11. NFGS 13283, Lead Based Paint Removal (NOTAL)

21-12. Title 29 CFR 1910.134, Respiratory Protection (NOTAL)

Appendix 21-A
Required Respirator

Airborne Concentration of Lead or Condition of Use	Required Respirator
Not in excess of 0.5 mg/m^3	Half mask, air purifying respirator (10xPEL) equipped with high efficiency filters [2,3]
Not in excess of 2.5 mg/m^3	Full face piece, air purifying respirator (50xPEL) with high efficiency filters[3]
Not in excess of 50 mg/m^3 (1000xPEL)	1. Any powered, air purifying respirator with high efficiency filters[3] or 2. Half mask, supplied air respirator operated in positive pressure mode
Not in excess of 100 mg/m^3 (2000xPEL)	Supplied-air respirators with full face piece, hood, helmet, or suit operated in positive pressure mode
Greater than 100 mg/m^3, unknown concentration or fire fighting.	Full face piece, self-contained breathing apparatus operated in positive pressure mode

[1]Respirators specified for high concentrations can be used at lower concentrations of lead.

[2]Full facepiece is required if lead aerosols cause eye or skin irritation at the use concentrations.

[3]A high efficiency particulate air (HEPA) filter means 99.97 percent efficient against 0.3 micron size particles. The equivalent NIOSH 42 CFR 84 particulate filters are P100 filters.